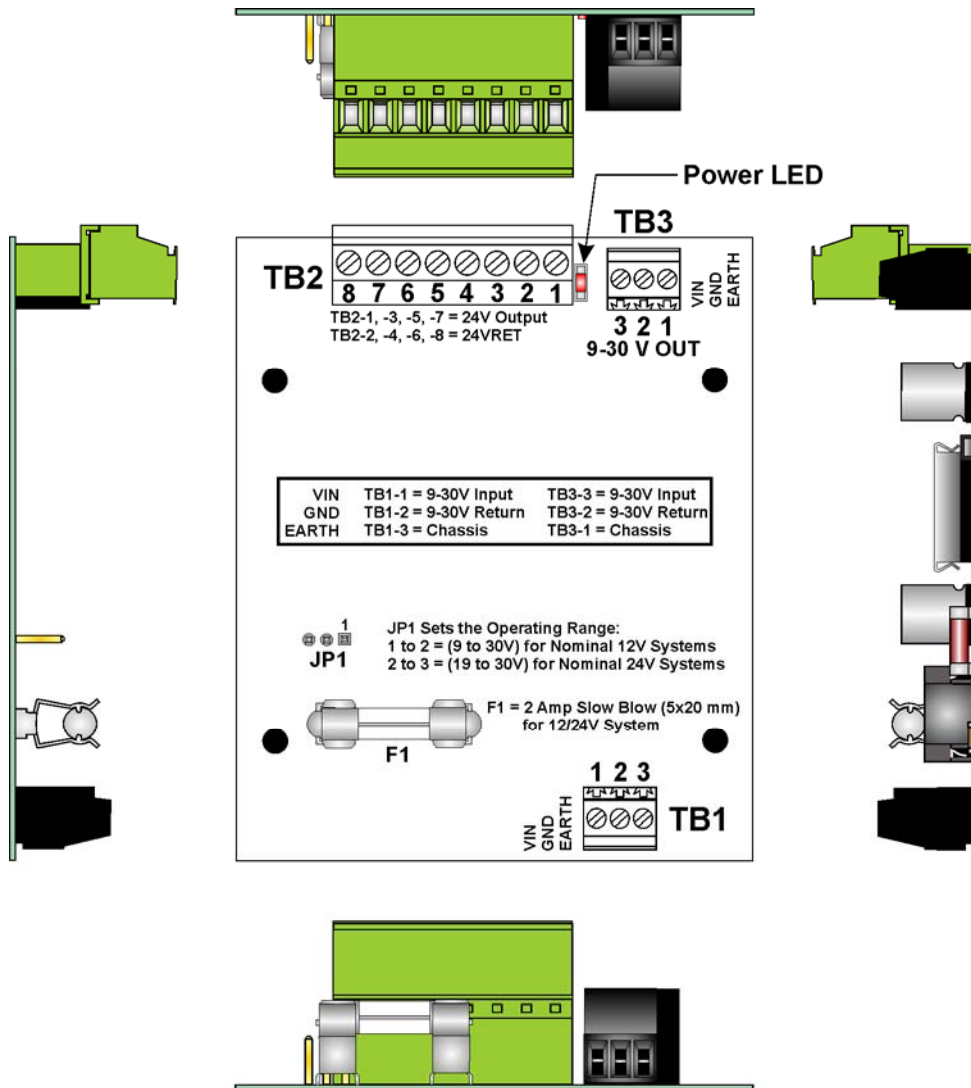


ControlWave LOOP POWER SUPPLY PRODUCT INSTALLATION GUIDE

For the following **ControlWave** Series
 Products: MICRO, EFM, GFC,
 ExpressPAC & Express



IMPORTANT! READ INSTRUCTIONS BEFORE STARTING!

Be sure that these instructions are carefully read and understood before any operation is attempted. Improper use of this device in some applications may result in damage or injury. The user is urged to keep this book filed in a convenient location for future reference.

These instructions may not cover all details or variations in equipment or cover every possible situation to be met in connection with installation, operation or maintenance. Should problems arise that are not covered sufficiently in the text, the purchaser is advised to contact Bristol for further information.

EQUIPMENT APPLICATION WARNING

The customer should note that a failure of this instrument or system, for whatever reason, may leave an operating process without protection. Depending upon the application, this could result in possible damage to property or injury to persons. It is suggested that the purchaser review the need for additional backup equipment or provide alternate means of protection such as alarm devices, output limiting, fail-safe valves, relief valves, emergency shutoffs, emergency switches, etc. If additional information is required, the purchaser is advised to contact Bristol .

RETURNED EQUIPMENT WARNING

When returning any equipment to Bristol for repairs or evaluation, please note the following: The party sending such materials is responsible to ensure that the materials returned to Bristol are clean to safe levels, as such levels are defined and/or determined by applicable federal, state and/or local law regulations or codes. Such party agrees to indemnify Bristol and save Bristol harmless from any liability or damage which Bristol may incur or suffer due to such party's failure to so act.

ELECTRICAL GROUNDING

Metal enclosures and exposed metal parts of electrical instruments must be grounded in accordance with OSHA rules and regulations pertaining to "Design Safety Standards for Electrical Systems," 29 CFR, Part 1910, Subpart S, dated: April 16, 1981 (OSHA rulings are in agreement with the National Electrical Code).

The grounding requirement is also applicable to mechanical or pneumatic instruments that include electrically-operated devices such as lights, switches, relays, alarms, or chart drives.

EQUIPMENT DAMAGE FROM ELECTROSTATIC DISCHARGE VOLTAGE

This product contains sensitive electronic components that can be damaged by exposure to an electrostatic discharge (ESD) voltage. Depending on the magnitude and duration of the ESD, this can result in erratic operation or complete failure of the equipment. Read supplemental document S14006 at the back of this manual for proper care and handling of ESD-sensitive components.

WARRANTY

- A. Bristol warrants that goods described herein and manufactured by Bristol are free from defects in material and workmanship for one year from the date of shipment unless otherwise agreed to by Bristol in writing.
- B. Bristol warrants that goods repaired by it pursuant to the warranty are free from defects in material and workmanship for a period to the end of the original warranty or ninety (90) days from the date of delivery of repaired goods, whichever is longer.
- C. Warranties on goods sold by, but not manufactured by Bristol, are expressly limited to the terms of the warranties given by the manufacturer of such goods.
- D. All warranties are terminated in the event that the goods or systems or any part thereof are (i) misused, abused or otherwise damaged, (ii) repaired, altered or modified without Bristol's consent, (iii) not installed, maintained and operated in strict compliance with instructions furnished by Bristol, or (iv) worn, injured or damaged from abnormal or abusive use in service time.
- E. THESE WARRANTIES ARE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED (INCLUDING WITHOUT LIMITATION WARRANTIES AS TO MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE), AND NO WARRANTIES, EXPRESS OR IMPLIED, NOR ANY REPRESENTATIONS, PROMISES, OR STATEMENTS HAVE BEEN MADE BY BRISTOL UNLESS ENDORSED HEREIN IN WRITING. FURTHER, THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION OF THE FACE HEREOF.
- F. No agent of Bristol is authorized to assume any liability for it or to make any written or oral warranties beyond those set forth herein.

REMEDIES

- A. Buyer's sole remedy for breach of any warranty is limited exclusively to repair or replacement without cost to Buyer of any goods or parts found by Seller to be defective if Buyer notifies Bristol in writing of the alleged defect within ten (10) days of discovery of the alleged defect and within the warranty period stated above, and if the Buyer returns such goods to Bristol's Watertown office, unless Bristol's Watertown office designates a different location, transportation prepaid, within thirty (30) days of the sending of such notification and which upon examination by Bristol proves to be defective in material and workmanship. Bristol is not responsible for any costs of removal, dismantling or reinstallation of allegedly defective or defective goods. If a Buyer does not wish to ship the product back to Bristol, the Buyer can arrange to have a Bristol service person come to the site. The Service person's transportation time and expenses will be for the account of the Buyer. However, labor for warranty work during normal working hours is not chargeable.
- B. Under no circumstances will Bristol be liable for incidental or consequential damages resulting from breach of any agreement relating to items included in this quotation, from use of the information herein or from the purchase or use by Buyer, its employees or other parties of goods sold under said agreement.

How to return material for Repair or Exchange

Before a product can be returned to Bristol for repair, upgrade, exchange, or to verify proper operation, form (GBU 13.01) must be completed in order to obtain a RA (Return Authorization) number and thus ensure an optimal lead time. Completing the form is very important since the information permits the Bristol Repair Dept. to effectively and efficiently process the repair order.

You can easily obtain a RA number by:

A. FAX

Completing the form (GBU 13.01) and faxing it to (860) 945-3875. A BBI Repair Dept. representative will return call (or other requested method) with a RA number.

B. E-MAIL

Accessing the form (GBU 13.01) via the Bristol Web site (www.bristolbabcock.com) and sending it via E-Mail to brepair@bristolbabcock.com. A BBI Repair Dept. representative will return E-Mail (or other requested method) with a RA number.

C. Mail

Mail the form (GBU 13.01) to

Bristol Inc.
Repair Dept.
1100 Buckingham Street
Watertown, CT 06795

A BBI Repair Dept. representative will return call (or other requested method) with a RA number.

D. Phone

Calling the Bristol Repair Department at (860) 945-2442. A Bristol Repair Department representative will record a RA number on the form and complete Part I, then send the form to the Customer via fax (or other requested method) for Customer completion of Parts II & III.

A copy of the completed Repair Authorization Form with issued RA number should be included with the product being returned. This will allow us to quickly track, repair, and return your product to you.

Bristol Inc. Repair Authorization Form (off-line completion)

(Providing this information will permit Bristol Inc. to effectively and efficiently process your return. Completion is required to receive optimal lead time. Lack of information may result in increased lead times.)

Date _____ RA # _____ SH _____ Line No. _____

Standard Repair Practice is as follows: Variations to this is practice may be requested in the "Special Requests" section.

- Evaluate / Test / Verify Discrepancy
- Repair / Replace / etc. in accordance with this form
- Return to Customer

Please be aware of the Non warranty standard charge:

- There is a \$100 minimum evaluation charge, which is applied to the repair if applicable (✓ in "returned" B,C, or D of part III below)

Part I Please complete the following information for single unit or multiple unit returns

Address No. _____ (office use only) Address No. _____ (office use only)

Bill to : _____ Ship to: _____

Purchase Order: _____ Contact Name: _____

Phone: _____ Fax: _____ E-Mail: _____

Part II Please complete Parts II & III for each unit returned

Model No./Part No. _____ Description _____

Range/Calibration _____ S/N _____

Reason for return : Failure Upgrade Verify Operation Other _____

1. Describe the conditions of the failure (Frequency/Intermittent, Physical Damage, Environmental Conditions, Communication, CPU watchdog, etc.)

(Attach a separate sheet if necessary)

2. Comm. interface used: Standalone RS-485 Ethernet Modem (PLM (2W or 4W) or SNW) Other: _____

3. What is the **Firmware** revision? _____ What is the **Software** & version? _____

Part III If checking "replaced" for any question below, check an alternate option if replacement is not available

A. If product is within the warranty time period but is excluded due to Bristol's warranty clause, would you like the product: repaired returned replaced scrapped?

B. If product were found to exceed the warranty period, would you like the product: repaired returned replaced scrapped?

C. If product is deemed not repairable would you like your product: returned replaced scrapped?

D. If Bristol is unable to verify the discrepancy, would you like the product: returned replaced *see below?

* Continue investigating by contacting the customer to learn more about the problem experienced? The person to contact that has the most knowledge of the problem is: _____ phone _____

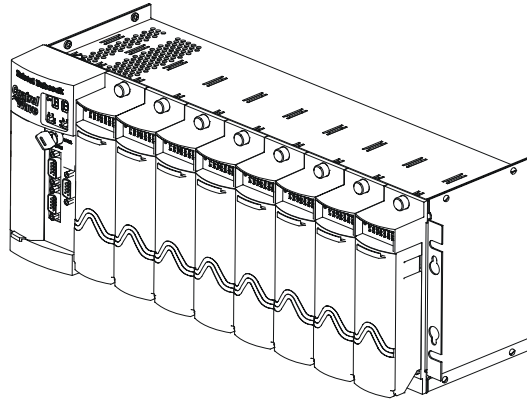
If we are unable to contact this person the backup person is: _____ phone _____

Special Requests: _____

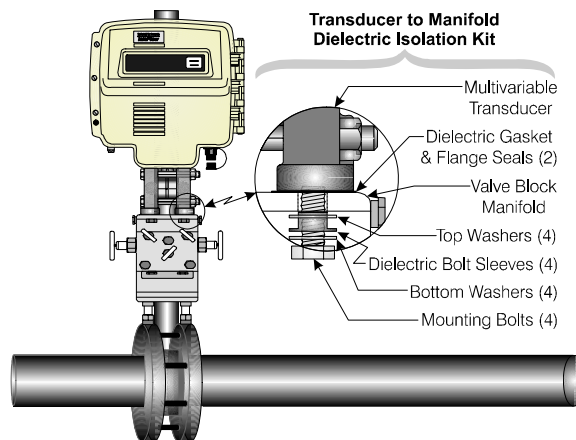
Ship prepaid to: Bristol Inc., Repair Dept., 1100 Buckingham Street, Watertown, CT 06795
Phone: 860-945-2442 Fax: 860-945-3875 Form GBU 13.01 Rev. B 04/11/06

Bristol *Training*

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- Avoid Delays and problems in getting your system on-line
- Minimize installation, start-up and maintenance costs.
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For information or to enroll in any class, contact our training department in Watertown at (860) 945-2343. For Houston classes, you can also contact our Houston office, at (713) 685-6200.

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For over 100 years, Bristol® has been providing innovative solutions for the measurement and control industry. Our product lines range from simple analog chart recorders, to sophisticated digital remote process controllers and flow computers, all the way to turnkey SCADA systems. Over the years, we have become a leading supplier to the electronic gas measurement, water purification, and wastewater treatment industries.

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Getting Additional Information

In addition to the information contained in this manual, you may receive additional assistance in using this product from the following sources:

Help Files / Release Notes

Many Bristol software products incorporate help screens. In addition, the software typically includes a 'read me' release notes file detailing new features in the product, as well as other information which was available too late for inclusion in the manual.

Contacting Bristol Inc. Directly

Bristol's world headquarters is located at 1100 Buckingham Street, Watertown, Connecticut 06795, U.S.A.

Our main phone numbers are:

(860) 945-2200
(860) 945-2213 (FAX)

Regular office hours are Monday through Friday, 8:00AM to 4:30PM Eastern Time, excluding holidays and scheduled factory shutdowns. During other hours, callers may leave messages using Bristol's voice mail system.

Telephone Support - Technical Questions

During regular business hours, Bristol's Application Support Group can provide telephone support for your technical questions.

For technical questions about TeleFlow products call (860) 945-8604.

For technical questions about **ControlWave** call (860) 945-2394 or (860) 945-2286.

For technical questions regarding Bristol's **OpenEnterprise** product, call (860) 945-3865 or e-mail: scada@bristolbabcock.com

For technical questions regarding **ACCOL** products, **OpenBSI Utilities**, **UOI** and all other software except for **ControlWave** and **OpenEnterprise** products, call (860) 945-2286.

For technical questions about **Network 3000** hardware, call (860) 945-2502.

You can e-mail the Application Support Group at: **bsupport@bristolbabcock.com**

The Application Support Group maintains an area on our web site for software updates and technical information. Go to: **www.bristolbabcock.com/services/techsupport/**

For assistance in interfacing Bristol hardware to radios, contact Bristol's **Communication Technology Group** in Orlando, FL at **(407) 629-9463** or **(407) 629-9464**.

You can e-mail the Communication Technology Group at:
orlandoRFgroup@bristolbabcock.com

Telephone Support - Non-Technical Questions, Product Orders, etc.

Questions of a non-technical nature (product orders, literature requests, price and delivery information, etc.) should be directed to the nearest sales office (listed on the rear cover of this manual) or to your Bristol-authorized sales representative.

Please call the main Bristol Inc. number (860-945-2200) if you are unsure which office covers your particular area.

Visit our Site on the World Wide Web

For general information about Bristol Inc. and its products, please visit our site on the World Wide Web at: **www.bristolbabcock.com**

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Bristol's Training Department offers a wide variety of courses in Bristol hardware and software at our Watertown, Connecticut headquarters, and at selected Bristol regional offices, throughout the year. Contact our Training Department at **(860) 945-2343** for course information, enrollment, pricing, and scheduling.

PIP-ControlWaveLS

ControlWave Loop Supply

Part Numbers 400095-01-7, 721708-01-3 & 721708-02-1

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Section 1

LOOP SUPPLY INTRODUCTION

1.1 GENERAL DESCRIPTION

Bristol's **ControlWave** Loop Power Supply (herein referred to as the "Loop Supply"), provides regulated and isolated 24Vdc power outputs that can be used to power field devices such as transmitters or non-isolated I/O circuits that are used in conjunction with **ControlWave MICRO**, **EFM**, **GFC**, **Express** or **Express PAC** units. Encapsulated Loop Supply's, i.e., those with the printed circuit board (PCB) secured to a Power Supply Back Plate Bracket and protected by a Power Supply Board Cover, may be mounted directly to a panel or to a 35mm DIN Rail while the PCB only version can be Snap Track mounted.

Loop Supply's provide 24Vdc field power distribution via four pairs of wiring terminals provided on Terminal Block TB2. Additionally, Loop Supply's are user configured via Jumper JP1 to operate in conjunction with either a nominal bulk 12Vdc input (with an input range of +9 to +30Vdc) or a nominal bulk 24Vdc input (with an input range of +19 to +30Vdc). Loop Supply's have been designed to provide the following features:

- 4 Loop Power Terminals pairs provide field device wiring flexibility and convenience.
- 9 - 30 Vdc bulk power input range accommodated installation flexibility
- Bulk power input can be applied to either of the three-terminal connectors (with one Terminal Block accommodating input wiring while the other may accommodate non-isolated power pass-through that is used to power the **ControlWave MICRO** (Process Automation Controller), **ControlWave EFM** (Electronic Flow Meter) **ControlWave GFC** (Gas Flow Computer), **Express** (Remote Terminal Unit), or **Express PAC** (Process Automation Controller/Remote Terminal Unit).
- Direct Panel, 35mm DIN Rail or Snap Track Mounting accommodated
- Small size minimizes panel space requirements

1.2 LOOP SUPPLY COMPONENT IDENTIFICATION

Loop Supply components that the user should become familiar with are discussed herein. These components include Connectors TB1, TB2 and TB3, Configuration Jumper JP1, the Power LED, and Fuse F1.

- **Terminal Blocks**

Loop Supply's are provided with three Terminal Blocks which accommodate up to #16 AWG size wire. Terminal Block Connections are provided in Tables 1 and 2.

Terminal Block TB1 typically acts as the interface for the bulk 9 to 30 Vdc input power. In some cases, TB1 may be used as the bulk dc power pass-through interface to an associated RTU in lieu of Terminal Block TB3. It should be noted that TB1 & TB3 can be used for Input Power or Power Pass-through with one accommodating input while the other may accommodate pass-through, e.g. if TB1 was used to interface bulk Input Power, than TB3 could be used to accommodate Power Pass-through, or vice versa.

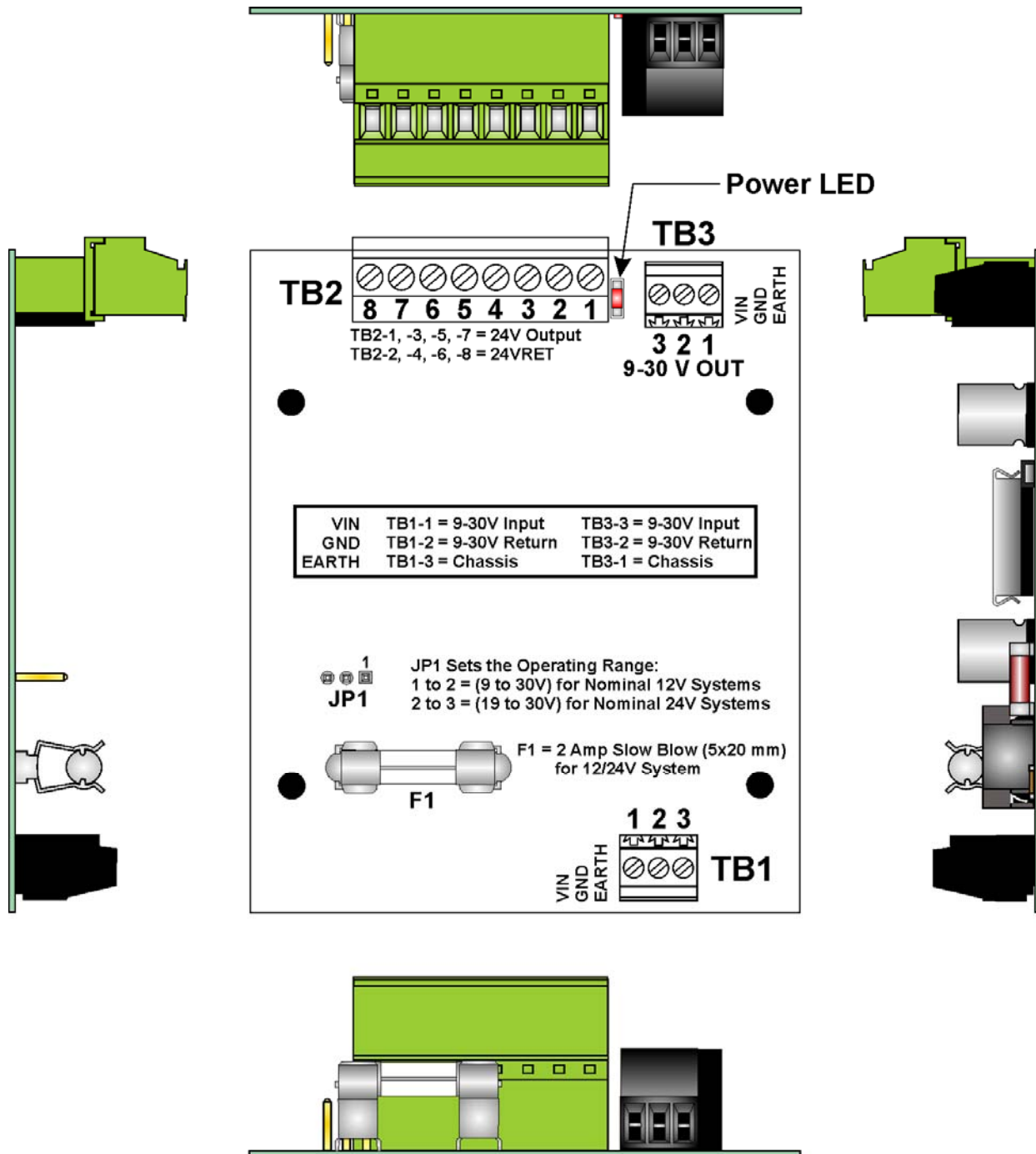


Figure 1 - ControlWave Loop Supply Board Views & Component Identification Diagram

Table 1 - Input/Pass-through Power Connectors – TB1 & TB3

TB1 Pin #	TB3 Pin #	Signal Name	Description	Notes
1	3	VIN	9 to 30 +Vdc power	Input or Non-fused Throughput
2	2	RET	9-30 Vdc Return	Input or Non-fused Throughput
3	1	CHASSIS	Chassis Ground	

8-Pin Connector (TB2) accommodates distribution of the regulated +24V loop supplies.

Table 2 - Regulated 24V Supply Distribution Connector TB2

TB2 Pin #	Signal Name	Description
1, 3, 5, 7	+24V	Regulated +24Vdc
2, 4, 6, 8	24V Return	Reg. 24V Return

- **Configuration Jumper JP1**

Jumper JP1 is used to set the input voltage range, i.e., 9V to 30V (nominal 12V input) or 19V to 30V (nominal 24V input). Under Voltage Lockout Point circuitry sources current to affectively lower the ON and OFF switch points.

The nominal setting **operating range switch points** for the Loop Supply (by design) are provided below.

JP1 - 1 to 2: 12V Input: ON above 8.4V (Max. ON = 8.8V), OFF below 8.24V (Min. OFF = 7.8V) (Factory Configuration)

JP1 - 2 to 3: 24V Input: ON above 18.8V, (Max. ON = 19.7V), OFF below 18.4V (Min. OFF = 17.4V)

- **Power LED**

Red LED (CR10) will be ON when regulated 24V is present. When lit, CR10 indicates that the Loop Supply is operational.

- **Fuse F1**

Fuse F1 (2A Slow Blow 5 x 20 mm) provides protection for the LOOP Supply and the associated field I/O (powered by Loop Supply). If a short circuit should occur in I/O field wiring or circuitry within the Loop Supply, F1 will blow and the regulated 24V output will switch OFF. **Note: Power Pass-through is not fused since the ControlWave GFCs/RTUs provide their own fuse protection.**

Section 2

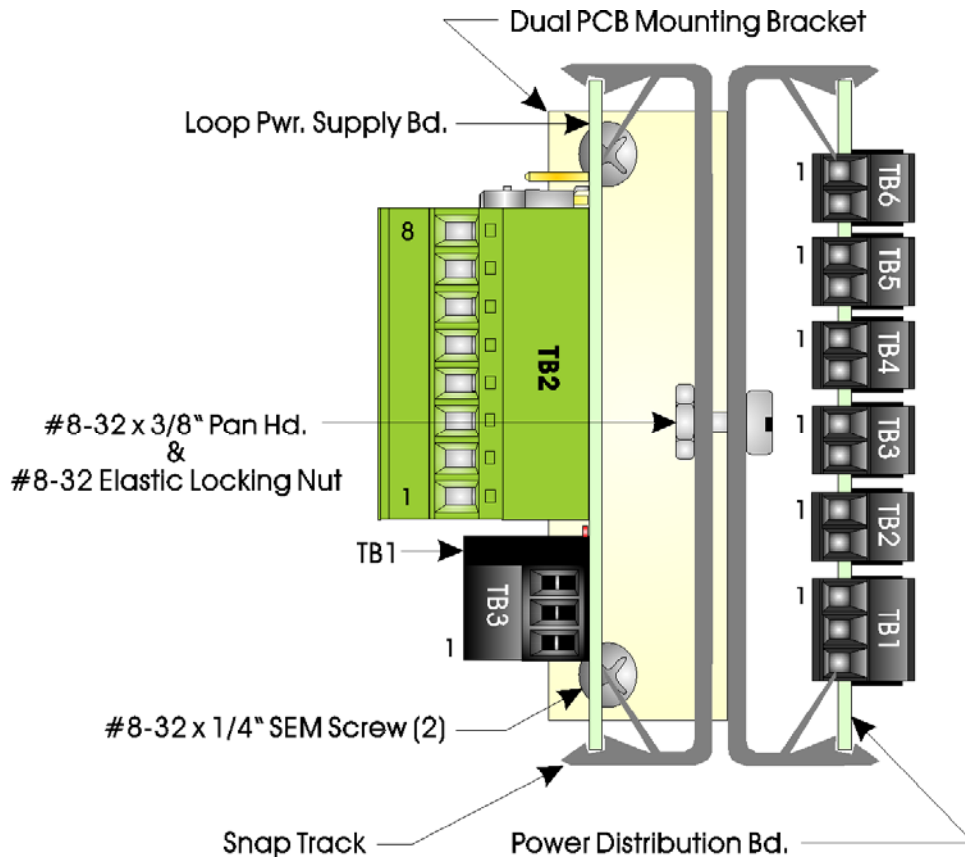
LOOP SUPPLY INSTALLATION

2.1 LOOP SUPPLY MOUNTING

Encapsulated Loop Supply Assemblies are provided with the printed circuit board (PCB) secured to a Power Supply Back Plate Bracket and protected by a Power Supply Board Cover. These units may be mounted directly to a panel or to a 35mm DIN Rail. Board only Loop Supply's are typically Snap Track mounted (as is the case with the **ControlWave EFM**). Figure 2 shows a Snap Track Mounted unit while Figure 3 provides dimensions for the "Encapsulated" Loop Supply. Table 3 below provides the type of Loop Supply and mounting arrangement typically associated with the various **ControlWave** series RTUs.

Table 3 - ControlWave RTU and Loop Supply Assignments

ControlWave Series	Loop Supply Type	Mounting Notes
ControlWave MICRO	Encapsulated	Externally
ControlWave EFM	Snap Track Mounted	Internally
ControlWave GFC	Snap Track Mounted	Internally
ControlWave Express	Encapsulated	Externally
ControlWave ExpressPAC	Snap Track Mounted	Internally



**Figure 2 - Snap Track Mounted Loop Supply
(Typically used in Conjunction with a Power Distribution Board)
(Shown Mounted to the ControlWave EFM Fabrication Panel)**

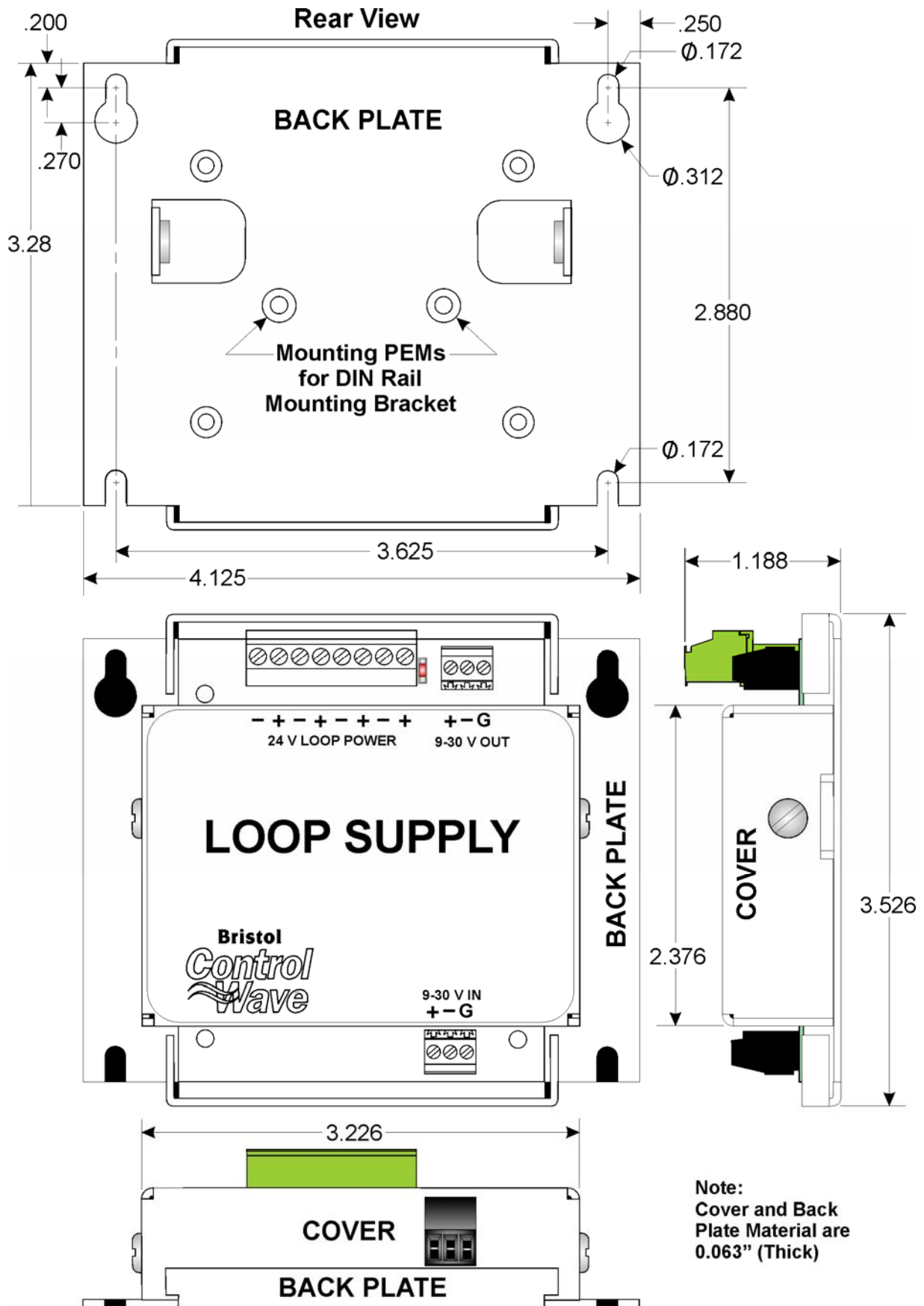


Figure 3 - Encapsulated ControlWave Loop Supply Mounting Diagram

2.2 LOOP SUPPLY WIRING

Loop Supply's utilize Terminal Blocks that are equipped with compression-type terminals which accommodate a #16 AWG size wire. A connection is made by inserting the wire's bared end (1/4" Max.) into the clamp beneath the screw and then tightening the screw. Three Loop Supply Terminal Blocks accommodate wiring as follows:

TB1 – Typically interfaces Bulk Power Input (May be used for Bulk Power Pass-through)

TB1-1 – VIN (9-30V Bulk Power Input)
TB1-2 – GND (9-30V Bulk Power Return)
TB1-3 – EARTH (CHASSIS Ground)

TB2 – 24Vdc Loop Power

TB2-1, 3, 5, 7 – 24V (Regulated +24V)
TB2-2, 4, 6, 8 – 24VRET (Regulated 24V Return)

TB3 – Typically interfaces Bulk Power Pass-through (May be used for Bulk Power Input)

TB3-1 – EARTH (CHASSIS Ground)
TB3-2 – GND (9-30V Bulk Power Return)
TB3-3 – VIN (9-30V Bulk Power Input)

Field I/O Wiring Considerations

Regardless of the **ControlWave** RTU type in question, Loop Supply wiring will only be utilized in conjunction with non-isolated I/O. Refer to Fig. 4 or 5 for applicable RTU wiring assignments.

In the case of **ControlWave Express**, **ExpressPAC** and **GFCs**, non-isolated AI and AO are available but, depending on the Input Voltage type, the unit's AI/AO will be internally or externally powered. For 24Vdc powered RTUs AI/AO loop power will typically be sourced directly from the unit's associated bulk power supply input. For 6V or 12V (dc) powered RTUs, both the non-isolated AI and non-isolated AO loop power may be provided by the Loop Supply's regulated 24Vdc power output via the EXT POWER Terminal (TB7-3) and GND terminal (TB7-4) on the Process I/O Board's Analog Output Terminal Block.

Power Input and Pass-through Wiring Considerations

In some cases the same bulk supply that powers the Loop Supply Assembly may be used to power the RTU. The bulk source should be wired to TB1 of the Loop Supply and then to RTU's power input terminal. If a Power Distribution Board is present, the bulk power source should be wired as follows:

First to Power Distribution Board Terminal Block TB1
Then from TB2 of the Power Distribution Board to TB1 of the Loop Supply
Then from TB3 of the Loop Supply to the RTU's Input Power Terminal.

Bulk power may be supplied from Loop Supply connector TB3 (pass-through) to one of the following RTU Input Power Terminals):

Controlwave MICRO – Power Supply/Sequencer Module (PSSM) - Connector TB1

TB1-1 = +VIN (from loop Supply Connector TB3-3 = VIN)
TB1-2 = -VIN (from loop Supply Connector TB3-2 = GND)

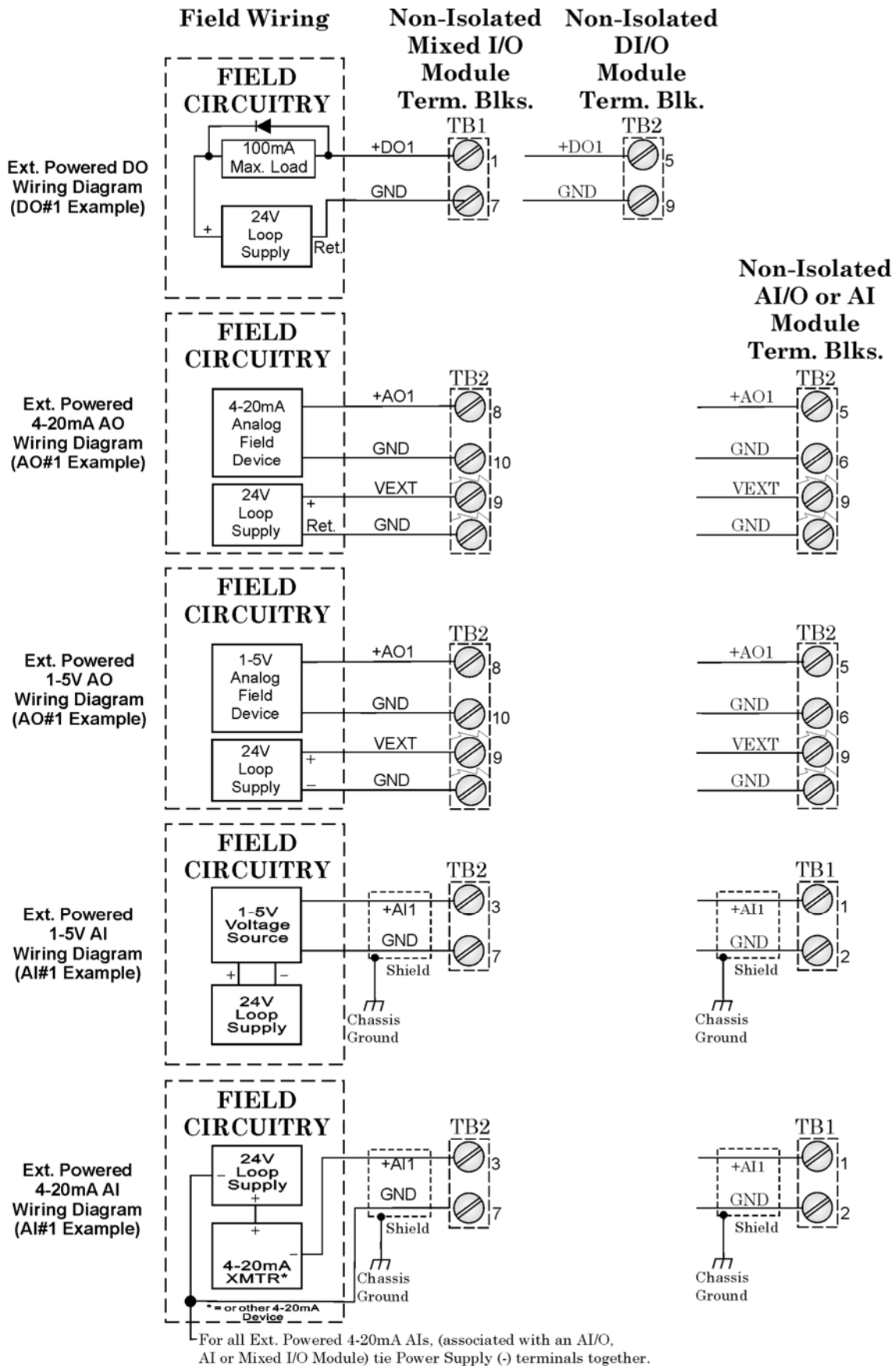


Figure 4 - ControlWave MICRO & EFM Loop Supply to I/O Module Wiring

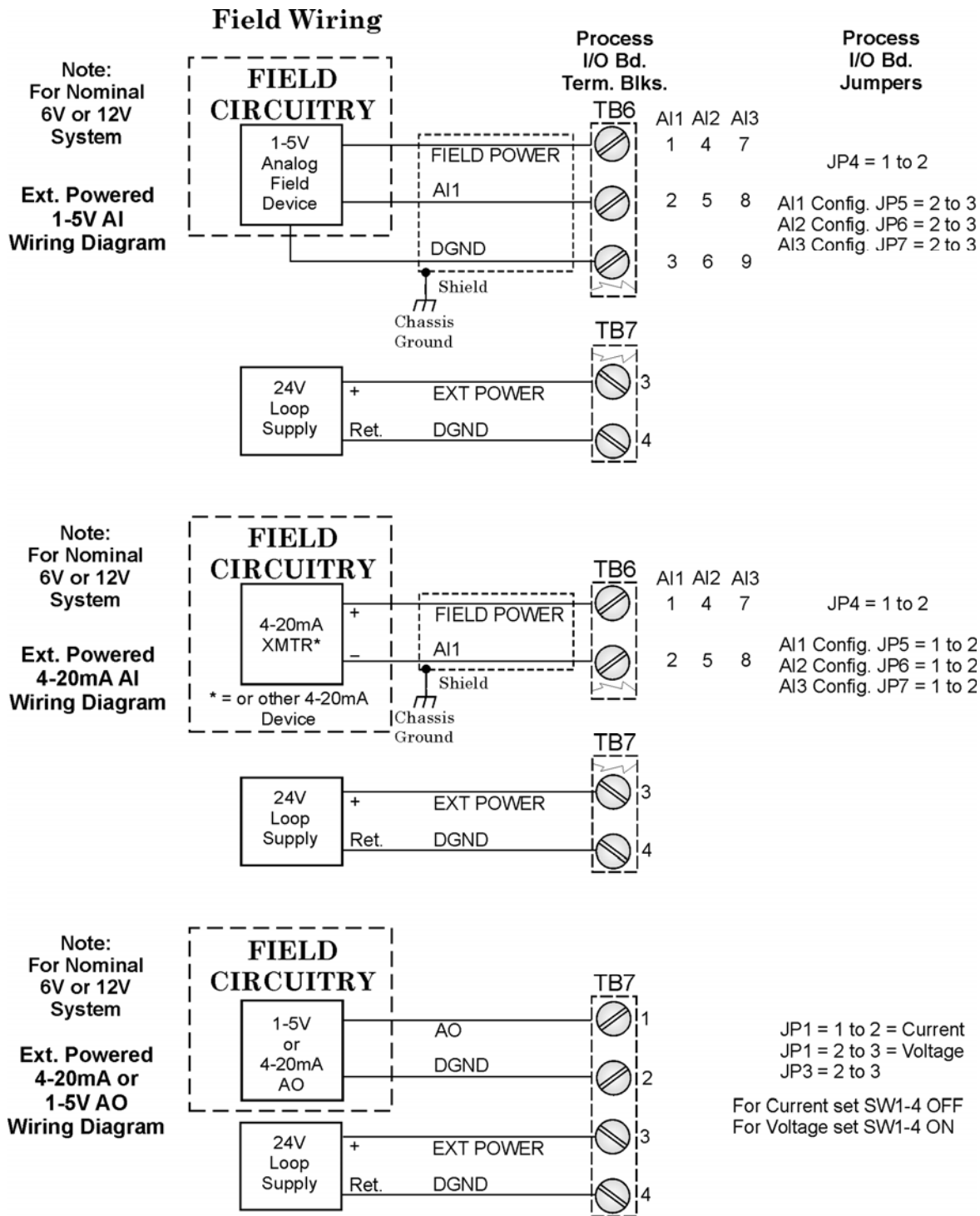


Figure 5 - ControlWave Express, ExpressPAC and GFC Loop Supply to Process I/O Board Wiring Diagrams

ControlWave EFM – System Controller Module - Connector TB1
 TB1-1 = +VIN (from loop Supply Connector TB3-3 = VIN)
 TB1-2 = -VIN (from loop Supply Connector TB3-2 = GND)

ControlWave Express – CPU/System Controller Board - Connector TB1
 TB1-3 = POWER IN+ (from loop Supply Connector TB3-3)
 TB1-4 = GND (from loop Supply Connector TB3-2)

ControlWave ExpressPAC – CPU/System Controller Board - Connector TB1

TB1-3 = POWER IN+ (from loop Supply Connector TB3-3)
TB1-4 = GND (from loop Supply Connector TB3-2)

ControlWave GFC – CPU/System Controller Board - Connector TB1

TB1-3 = POWER IN+ (from loop Supply Connector TB3-3)
TB1-4 = GND (from loop Supply Connector TB3-2)

Section 3

SPECIFICATIONS

3.1 OPERATING SPECIFICATIONS

Function:	Provides four isolated 24Vdc power output terminal pairs to power an RTU , a Transmitter and/or a number of non-isolated I/O (associated with a particular ControlWave RTU).
Output Voltage :	Electrically Isolated & Regulated 24Vdc $\pm 5\%$, no load or full load
Output Current:	0.2A maximum, power limited to 150% of Max. rated power
Supply Shutdown:	Below +9Vdc or +19Vdc (Nominal) for 12V or 24V system (respectively) 12V System: Max. ON Switchpoint = 8.8V Max. OFF Switchpoint = 7.8V 24V System: Max. ON Switchpoint = 19.7V Max. OFF Switchpoint = 17.4V
Input Voltage:	+9 to +30 Vdc
Input Current:	Supply Loading: 24V @ 0.2A Vin @ +9V In Max. = .85A Vin @ +12V In Max. = .58A Vin @ +24 In Max. = .29A
Fusing:	2A Slow Blow (5x20 mm) Fuse for 12V/24V System
Electrical Isolation:	500Vdc (Transformer Coupled)
Surge Suppression:	500Vdc (MOV between 24V return and CHASSIS) 30V Transient Suppressor across VIN(9-30V)/GND, 24V/24V Return – meets ANSI/IEEE C37.90-1978
Terminations:	Fixed, Max. wire size is 16 guage

3.2 ENVIRONMENTAL SPECIFICATIONS

Temperature:	Operating Range: -40° to +85°C (-40° to 185°F) Storage Range: -40°to +85°C (-40°to 185°F)
Relative Humidity:	15% to 95% (Non-condensing)

Vibration: 1g for 10-500 Hz on any axis per SAMA PMC-31-1 without damage or impairment.
.5g for 150-2000Hz

RFI Susceptibility: 10V/meter – 80MHz to 1000MHz

3.3 CONNECTORS

3.3.1 Terminal Block TB1

3-Pin Terminal Block TB1 accommodates input power from the bulk DC source. TB1 could act as a power pass-through interface to an RTU (in lieu of connector TB3) (see Table 1).

3.3.2 Terminal Block TB3

3-Pin Terminal Block TB3 typically accommodates pass-through power to the associated **ControlWave** RTU but could act as the Loop Supply input power interface (in lieu of connector TB1) (see Table 1).

3.3.3 Terminal Block TB2

8-Pin Terminal Block TB2 accommodates distribution (four pairs of wiring terminals) of regulated +24Vdc loop power (see Table 2).

3.4 PART NUMBERS

400095-01-7 Snap Track Mount
721708-01-3 Panel Mount
721708-02-1 35mm DIN Rail Mount

3.5 DIMENSIONS

Dimensions are provided in Figure 6.

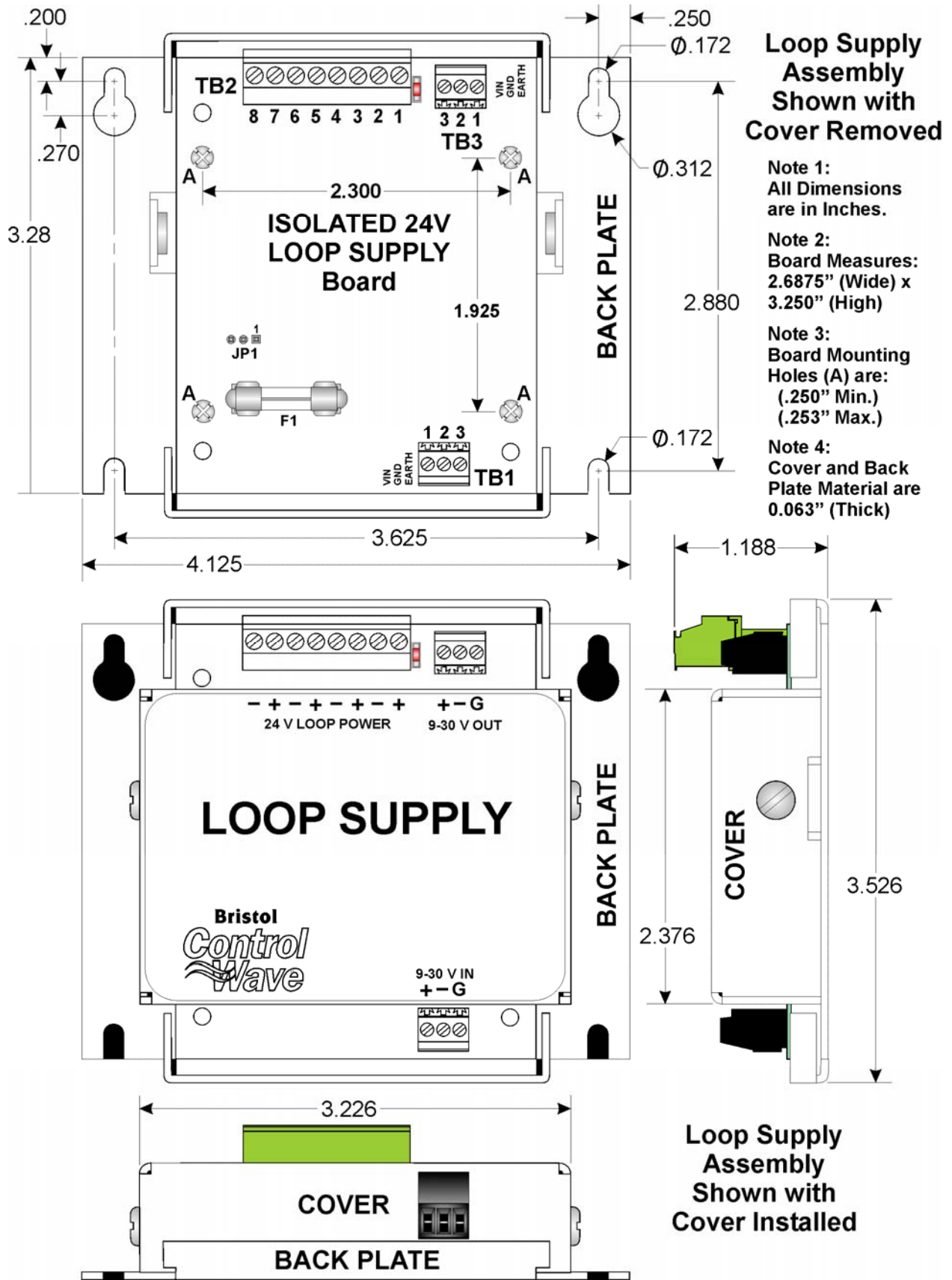


Figure 6 - Loop Supply Dimensions Drawing

ControlWave Loop Power Supply

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